Claims

1. An electrochemical sensor comprising:
an electrochemical cell having a sensor means;
fluid flow control means positioned so as to release a fluid jet onto the sensor means, the fluid flow control means having means for controlling the velocity of the fluid jet, the fluid flow velocity being defined by the Reynolds number of the fluid when the fluid is in the fluid flow control means; and
wherein control of the Reynolds number and measurement of the electrical output of the sensor provide a measure of the build-up of scale on the working electrode.

2. An electrochemical sensor as claimed in claim 1 wherein, the measure of scale build up quantifies the scale build up on the sensor surface in the electrochemical cell.

3. An electrochemical sensor as claimed in claim 1 wherein, the sensor detects scale build up to measure the scaling tendency of the fluid.

4. An electrochemical sensor as claimed in any preceding claim wherein, the fluid control means is a conduit provided with a control valve or pump.

5. An electrochemical sensor as claimed in any preceding claim wherein, the sensor measures the change in electrical output as a function of Reynolds Number during use of the fluid flow control means

6. An electrochemical sensor as claimed in any preceding claim wherein, the electrical output measurement means measures the limiting current response of the sensor as a function of Reynolds Number.

7. An electrochemical sensor as claimed in any preceding claim, wherein the fluid flow control means is a conduit having a predefined diameter (d) and is positioned at a height (H) above the sensor having a radius (r).

8. An electrochemical sensor as claimed in claim 7 wherein laminar flow of the fluid from the fluid control means is provided by setting said diameter (d), height (H) and radius (r).

9. An electrochemical sensor as claimed in claim 7 wherein $H/d = 1$; and $r/d<0.5$.

10. An electrochemical sensor as claimed in any preceding claim further comprising fluid sampling means for obtaining a sample of a test fluid.

11. An electrochemical sensor as claimed in any preceding claim wherein, the fluid sampling means contains fluid isolation means for isolating the test fluid from a bulk fluid.

12. An electrochemical sensor as claimed in claim 8 wherein , the fluid isolation means is provided by a container having at least one sealable valve which, when opened, allows the test fluid to enter the sampling means.

13. An electrochemical sensor as claimed in any preceding claim wherein, the fluid flow control means comprises a flow meter or flow sensor for measuring flow, connected to a conduit from which said fluid jet is expelled.

14. An electrochemical sensor as claimed in any preceding claim wherein, the sensor comprises a working electrode, a counting electrode and a reference electrode.

15. An electrochemical sensor as claimed in any preceding claim wherein, the electrochemical sensor further comprises a reservoir for storing a second, pre-prepared electrolyte, flow control means and one or more conduits connected to the electrical cell such that the pre-prepared electrolyte is used with the electrical cell to measure the quantity of scale deposited by the test fluid by measuring the electrical output of the cell as a function of Reynolds number.

16. An electrochemical sensor as claimed in claim 15, wherein the electrolyte is a solution.

17. An electrochemical sensor as claimed in claim 15 or claim 16 wherein, the electrolyte is a solution of brine containing a suitable tracer.

18. An electrochemical sensor as claimed in claim 17 wherein the tracer is ionic.

19. An electrochemical sensor as claimed in claim 17 wherein the tracer is oxygen.

20. An electrochemical sensor as claimed in claims 15 to 19 wherein, the pre-prepared solution has a saturation ratio of less than 1.

21. An electrochemical sensor as claimed in claims 15 to 20 wherein, the pre-prepared solution has a saturation ratio of greater than 1.

22. A method of measuring the scaling properties of a test fluid, the method comprising the steps of:
controlling the velocity of a fluid jet as defined by the Reynolds number of the fluid when the fluid is in a fluid flow control means;
releasing the fluid jet from the fluid control means onto a sensor of an electrochemical cell; and
measuring the electrical output from the sensor as a function of the Reynolds number of the jet fluid, the sensor being in contact with a sample of the test fluid.

23. The method of claim 20 wherein, the sensor gives a measure of the change in electrical output as a function of Reynolds number during use of the fluid flow control means.

24. The method of claim 22 or 23 wherein, the electrical output provides a measure of the limiting current response of the electrochemical cell as a function of Reynolds Number.

25. The method of claims 22 to 24, wherein the fluid flow control means is a conduit having a predefined diameter

(d) and is positioned at a height (H) above the working electrode or sensor having a radius (r).

26. The method of claim 25, wherein laminar flow of the fluid from the fluid control means is provided by setting said diameter (d), height (H) and radius (r).

27. The method of claim 25 or claim 26 wherein H/d = 1; and r/d<0.5.

28. A method as claimed in claims 22 to 27 comprising the further step of isolating the test fluid from a flowing fluid prior to measuring the electrical output from the electrical cell as a function of the Reynolds number of the fluid.

29. A method as claimed in claim 28 wherein, the test fluid is isolated by closing valves arranged upstream and downstream of a predetermined measuring location in a sample measuring means.

30. A method as claimed in claims 22 to 29 wherein the fluid is isolated by removably attaching a sampling conduit to a first conduit in which the bulk of the fluid is situated, and by providing valves to isolate the sampling conduit from the first conduit.

31. A method of measuring the scaling properties of a test fluid, the method comprising the steps of:
introducing a jet of test fluid into an electrochemical cell so as to allow scale to build up on one or more surfaces in the cell;
removing the test fluid from the electrochemical cell;

introducing a pre-prepared solution into the cell; and measuring the electrical output from the electrochemical cell.

32. A method as claimed in claim 31 wherein, the test fluid is introduced into the electrochemical cell at a rate defined by the Reynolds Number of the fluid when contained in a first fluid control means.

33. A method as claimed in claim 31 or claim 32 wherein, the pre-prepared solution is introduced into the electrochemical cell at a rate defined by the Reynolds number of the fluid when contained in a second fluid control means.

34. The method of claims 31 to 33 wherein, the electrical output measures the change in electrical output as a function of Reynolds Number during use of the fluid flow control means.

35. The method of claims 31 to 34 wherein, the electrical output provides a measure of the limiting current response of the electrochemical cell as a function of Reynolds Number.

36. The method of claims 31 to 35, wherein the fluid flow control means is a conduit having a predefined diameter (d) and is positioned at a height (H) above the working electrode or sensor having a radius (r).

37. The method of claim 36, wherein laminar flow of the fluid from the fluid control means is provided by setting said diameter (d), height (H) and radius (r).

38. The method of claim 36 or claim 37 wherein $H/d = 1$; and $r/d<0.5$.

39. A method as claimed in any of claims 36 to claim 38 wherein, the pre-prepared solution has a saturation ratio of less than 1.

40. A method as claimed in any of claims 36 to claim 39 wherein, the pre-prepared solution has a saturation ratio of greater than 1.